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# PATENT ABSTRACTS OF JAPAN

(11)Publication number : **07-111239**

(43) Date of publication of application : **25.04.1995**

(51)Int.CI.

H01L 21/027

G03F 7/20

(21)Application number : 05-277326

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(22)Date of filing : **12.10.1993**

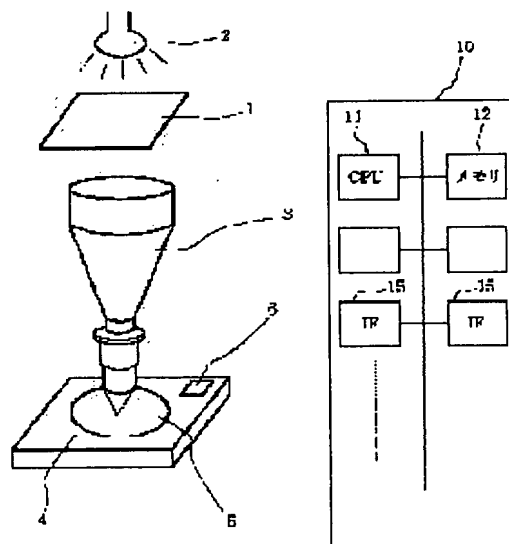
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**(54) ALIGNER**

(57)Abstract:

**PURPOSE:** To make it possible to correct automatically aberration of a lens 42 of an optical system by providing pattern writing means through correction exposure pattern data so that the aberration can be cancelled according to the result of detecting aberrations in exposure pattern delineation on a reticle or a mask.

CONSTITUTION: A CPU 11 reads reference grating pattern data from a memory 12, transmits them to a reticle 1 to form the reference grating pattern data. Further, it drives a stage 4 to move a sensor 6 to a field of vision of an optical system 3 and makes an imprint image by the reference grating pattern of the optical system 3 projected on the sensor 6, computes the amount of aberration from the reference grating, and obtains an error from an ideal imprint image. And it forms new pattern data by multiplying the exposure pattern data by an error correction so that the correct imprint image can be drawn on the reticle 1 after previous data are cleared. This enables data correction to be made or the aberration of the optical system to facilitate matching between aligners.



## LEGAL STATUS

[Date of request for examination]

13.11.1997

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

3107958

[Date of registration]

08.09.2000

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the aligner in which automatic amendment of the lens distortion of optical system is possible especially about the aligner used for the lithography process in a semi-conductor production process.

[0002]

[Description of the Prior Art] It is the lithography process (pattern imprint by the aligner) which there is not with how often and is used by the semi-conductor production process, and it is important to abolish the error between processes. As [ become / a product / pattern gap occurs and / when an error is produced / impossible ]

[0003] In a semi-conductor process, the pattern imprint approach is divided roughly and there are two kinds. One is the approach of imprinting on a wafer the pattern made by a mask or reticle from the start through optical system. Another is a straight-writing type which draws a direct pattern by EB (electron beam) or the laser beam.

[0004] In order that the former may imprint the already drawn pattern, the throughput is fastening the quick current mainstream. However, an error with the pattern exposed first widens, so that superposition frequency increases, since the error between equipment is included. Moreover, since many reticles or masks are needed depending on the class of semi-conductor, there is room of amelioration. In order to draw the latter directly for every wafer, it has the fault that a throughput is late to the degree of pole.

[0005] In the conventional aligner which imprints the pattern formed in a mask or reticle, there is a fault shown below further.

[0006] (1) It is not easy to take matching between aligners.

[0007] (2) reticle or a mask -- a part for a routing counter -- many -- several sheets are required.

[0008] (3) There is aging of optical system.

[0009] On the other hand, the aligner which can carry out all the exposure processes of one wafer with one equipment, without not creating many masks for every exposure process, and exchanging masks is proposed by JP,1-155347,A by using a transparency form flat-surface display as the above-mentioned mask.

[0010] However, the aligner of JP,1-155347,A also solves neither aging of optical system, nor the problem of matching between aligners.

[0011]

[Problem(s) to be Solved by the Invention] This invention was made in view of the trouble in the above-mentioned conventional example, and aims at offering the aligner in which automatic amendment of the lens distortion of optical system is possible.

[0012]

[Means for Solving the Problem] In order to attain the above-mentioned object the aligner of this invention The reticle or the mask in which elimination and the store of a pattern are possible, and a pattern write-in means to draw a pattern on this reticle or a mask based on the given pattern data, The optical system which projects the imprint image of the pattern which illuminated this reticle or a mask and was drawn on this reticle or a mask on an exposed location, A reference grid is made to draw on the sensor which detects the imprint image projected by said optical system, and this reticle

or a mask. The aberration of said optical system is detected based on the criteria lattice image which was made to detect said imprint image by said sensor, and was detected. In case the pattern for exposure is made to draw on said reticle or a mask, it is characterized by providing the control means which amends the pattern data for exposure that this aberration should be offset based on this aberration detection result, and is given to said pattern write-in means.

[0013] In one example of this invention, the flat-surface display of a transparency form is used as said reticle or a mask.

[0014] In other examples of this invention The film with which said reticle or mask can be charged, It has 2 sets of electrode groups groups and the direction of said stripe cross at right angles mutually while consisting of a stripe-like transparent electrode of a large number located in a line with parallel, respectively and counteracting on both sides of said film which can be charged. Said control means is memorized with the digital data as rectangular coordinates which show each intersection of the stripe-like transparent electrode which constitutes said 2 sets of electrode groups for the data of the reference grid pattern which should draw on said reticle or mask, and the pattern for exposure. Said write-in means electrifies the part which the pattern data given from said control means of said film which can be charged show, and draws a pattern by applying a magnetic fluid to this electrification part selectively.

[0015]

[Function] According to the aligner of this invention, reticle or a mask with electric ON / off signal (digital information) It catches by the sensor in the location [ it is possible to draw a pattern on reticle or a mask, and ] which a reference grid is first drawn on reticle or a mask, and can receive an imprint stage top or imprint \*\*\*\* as imprint \*\*\*\* after optical-system transparency. Based on a carrier beam imprint signal, the amount of gaps from a reference grid etc. is computation-calculated for an error with an ideal imprint image by CPU etc. by this sensor. The new pattern data to which error correction was applied to the data of the pattern for exposure required for a semi-conductor fabrication etc. are created, and after clearing before data on reticle or a mask, he is trying to draw.

[0016] Thus, it can consider as the pattern data which took \*\* optical-system aberration into consideration by drawing the pattern for exposure on reticle or a mask, after applying error correction.

[0017] \*\* It becomes easy to take matching between equipment.

[0018] \*\* reticle or a mask -- a large number -- it is not necessary to have -- data, such as MT, -- it is good.

[0019] \*\* By the data input, the creation of a new pattern also of pattern modification is attained (circumference exposure, numbering on a wafer, etc. can be inputted into this pattern data as information).

[0020] \*\* Aging amendment of optical system is attained.

[0021]

[Example] Hereafter, the example of this invention is explained based on a drawing.

[0022] Drawing 1 shows the configuration of the aligner concerning one example of this invention. In this drawing, 1 is the reticle (or mask) of a transparency form, for example, can use a transparency form liquid crystal display. The light source to which 2 illuminates reticle 1, the optical system on which 3 projects the pattern image of reticle 1, and 4 carry the semi-conductor wafer 5, and are a movable stage. The CCD sensor 6 is arranged on the stage 4. 10 is the control device which controls actuation of this whole aligner, and is equipped with the various interface 15 grades for connecting CPU 11, memory 12 and the above-mentioned reticle 1, the light source 2, the shutter equipment that is not illustrated, optical system 3, a stage 4, and sensor 6 grade and this control device 10.

[0023] Next, actuation of the equipment of drawing 1 is explained, referring to the flow chart of drawing 2. The data of the pattern used with a reference grid pattern and the semiconductor integrated circuit which should be manufactured shall be beforehand stored in external memory equipments, such as a magnetic tape unit, with the program for operating the above CPU 11 etc., and the data of the above-mentioned reference grid pattern shall be read into the above-mentioned memory 12 at the time of the program load of this aligner. Moreover, the data of the reticle pattern which should be used by exposure processing shall be transmitted to memory 12 from the above-mentioned external memory equipment, when the reticle pattern which should be used by exposure

processing is specified by a keyboard etc. Furthermore, initialization which needs predetermined fields, such as a register of the amount calculated value of distortion in memory 12, shall be given. [0024] If ordered in initiation of operation by the input from a set or a keyboard of a semi-conductor wafer etc., first, CPU11 reads the data of a reference grid pattern from memory 12, and sends them out to reticle 1 (step 101). Thereby, a reference grid pattern is formed in reticle 1. Furthermore, a stage 4 is driven, a sensor 6 is moved into the visual field of optical system 3, the light of the light source 2 is irradiated at reticle 1, and the imprint image by the optical system 3 of a reference grid pattern is made to project on a sensor (step 102). Subsequently, the data of the reference grid pattern imprint image from a sensor 6 are incorporated, and it judges whether distortion is in the imprint image by carrying out data processing of this (step 103). If there is no distortion, processing will be shifted to the below-mentioned step 121.

[0025] On the other hand, when there is distortion, after calculating the amount of distortion of each coordinate (step 111) and eliminating the reference grid pattern on reticle (step 112), where the above-mentioned reference grid is amended with the amount calculated value of distortion, it draws on reticle 1 (step 113), and projects on a sensor 6 (step 114). And it judges whether distortion of a criteria lattice image was able to be taken based on the sensor output at that time (step 115). If distortion can be taken, processing will be shifted to the below-mentioned step 121. On the other hand, if distortion cannot be taken, after re-calculating the amount of distortion of each coordinate based on the last amount calculated value of distortion, and this sensor output (step 111), processing of the above-mentioned steps 112-115 is repeated.

[0026] A reticle pattern is eliminated at step 121. Then, where the pattern of the semiconductor integrated circuit which should be manufactured is amended in the amount of distortion calculated at step 111, it draws on reticle 1 (step 122), and a wafer is carried on a stage 4, a stage 4 is moved, and it exposes to this wafer.

[0027] In addition, although the example which performs aberration judging processing for one kind of every pattern in \*\*\*\* was shown, such processing may be performed for every lot of a wafer, or you may carry out for every predetermined period, for example, a periodic-check period. Moreover, when exposing all the patterns of one kind of semiconductor integrated circuit with the same aligner, you may carry out for every predetermined number of sheets of the semiconductor integrated circuit, and every lot.

[0028] Furthermore, above-mentioned reticle may be a liquid crystal display which draws a pattern with laser as shown in JP,1-155347,A.

[0029]

[Other Example(s)] Drawing 3 shows the configuration of the aligner concerning the 2nd example of this invention. The equipment of this drawing applies an electrostatography technique to the part of reticle (or mask) 1 to the thing of drawing 1. Namely, according to this example, a mask or reticle is covered by the ferroelectric film etc., and a magnetic fluid etc. can draw now on the part to which potential was impressed as a mask/a reticle image. In both sides of the ferroelectric film, the electrode group for impressing potential to a desired pattern configuration is arranged. These electrode groups consist of a stripe-like transparent electrode of a large number located in a line with parallel, respectively, and the direction of those stripes lies at right angles mutually by both sides.

[0030] The pattern information input circuit where 31 consists of external memory equipment, a keyboard, mice, etc., such as a magnetic tape unit, in drawing 3, The pattern information amendment circuit which 32 consists of CPUs etc. and controls processing like drawing 2, It is based on the output of the pattern information amendment circuit sent out by 33 minding an input signal circuit and 34 minding the input signal circuit 33. The control circuit which creates a required driving signal since reticle 1 is driven, or supplies the driving signal according to the timing formed in the timing actuation circuit 35, An electrical signal line for the timing actuation circuit which 35 creates the timing signal for driving reticle 1, and impresses the above-mentioned driving signal to reticle 1 to the timing, and 36 to connect the timing actuation circuit 35 and the stripe-like transparent electrode of reticle 1, and 37 are connectors.

[0031] Also in the aligner of drawing 3, by drawing a reference grid and receiving the imprint image after optical-system transparency by the sensors 6, such as CCD, first, like the thing of drawing 1, the amount of gaps of a reference grid is recognized by CPU processing count, and amendment is

made possible. Therefore, amendment can be applied so that it may stop being on reticle or a mask about errors, such as aberration of a projection optical system 3, and the imprint image error on a wafer can be abolished.

[0032] In addition, by giving reverse potential to the potential impression section, collecting the magnetic fluids drawn on a mask or reticle in modification of a pattern, and impressing the potential accompanying again new data, pattern drawing is enabled again and it is considering as the configuration without the need of having many reticles or masks. Patternizing a reference grid pattern and the pattern for semiconductor integrated circuit manufacture by ON/OFF of an electrical signal, a pattern operates for the information from CPU.

[0033] Drawing 1 and the reticle part of drawing 3 may serve as structure of drawing 4. For 1, in drawing 4, reticle and 1a of the transparence electric conduction film and 36 are [ an electrical signal line and 37 ] connectors. A thing like a magnetic fluid as a medium for forming a pattern on reticle is mentioned. The electrode which intersected perpendicularly is formed with the transparence electric conduction film, it connects with the circuit which consists of the timing actuation circuit shown in drawing 3, a control circuit, an input signal circuit, a pattern information amendment circuit, and a pattern information input circuit to this electrode, and information data are given in the state of a charge on rectangular coordinates. Thereby, reticle makes the condition of having had the charge of + or - selectively hold. Here, the rearrangement of the magnetic fluid is carried out to the part 62 which the charge on reticle has required by scanning on reticle the roller 61 which the magnetic fluid attached. Exposure is carried out on a wafer in this condition.

[0034] A reticle top becomes possible [ completely returning to an early condition ] by after the completion of exposure having the need for initialization, covering the charge covered on reticle at the beginning, and the charge of reverse, and scanning a roller side.

[0035] Drawing 5 shows the example which used the reticle (or mask) of a reflex. The reticle (or mask) of drawing 5 consists of high reflective substrate section 1b and ferroelectric section 1c. Ferroelectric section 1c has the configuration shown in drawing 4, and it is possible to attach a magnetic fluid etc. like drawing 6. In addition, it becomes easy by using a substrate (high reflective substrate section 1b) as a metal to return a charge. In drawing 6, 61 is the roller which the magnetic fluid attached. This roller may be the magnetic brush which is used for an electrostatic process copying machine.

[0036] In addition, usage like reticle/mask is usable also as the mask section of drawing in optical system (aperture), or deformation lighting, and it becomes easy by carrying out like this to parameterize various optical conditions. [ as / in this invention ]

[0037]

[Effect of the Invention] As explained above, according to this invention, the reference grid on reticle or a mask can be projected on a sensor, and the data correction to the aberration of optical system can be applied by carrying out CPU processing count of the sensor output. For this reason, matching between aligners becomes easy and it becomes possible to also negate aging of body optical system. Moreover, it becomes possible to also make each size adjustment of optical system simplify.

[0038] Furthermore, since reticle or a mask is possible for writing/elimination, it becomes possible for there to be no need of having many reticles or masks, and to measure a large cost cut.

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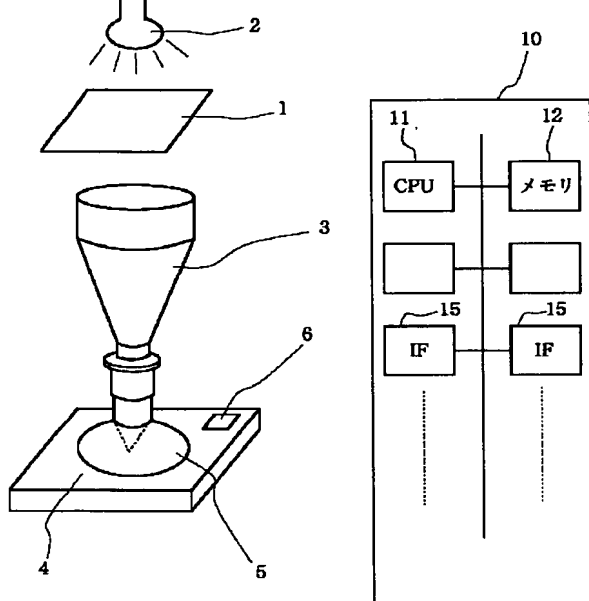
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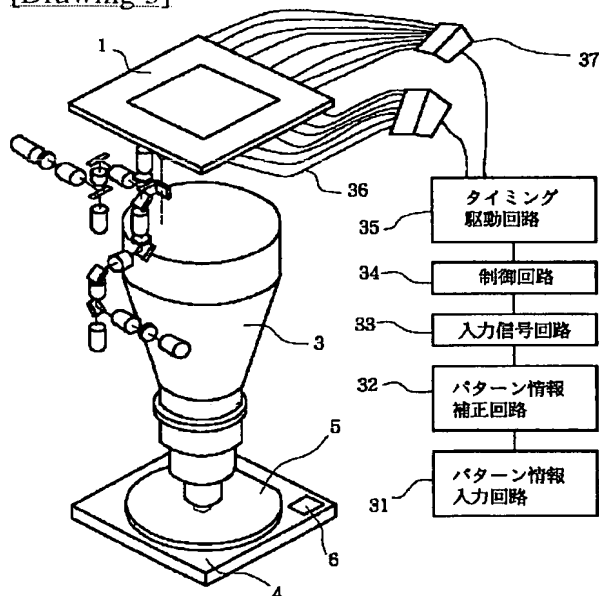
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## DRAWINGS

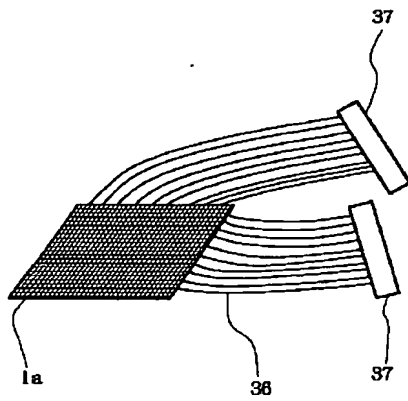
[Drawing 1]



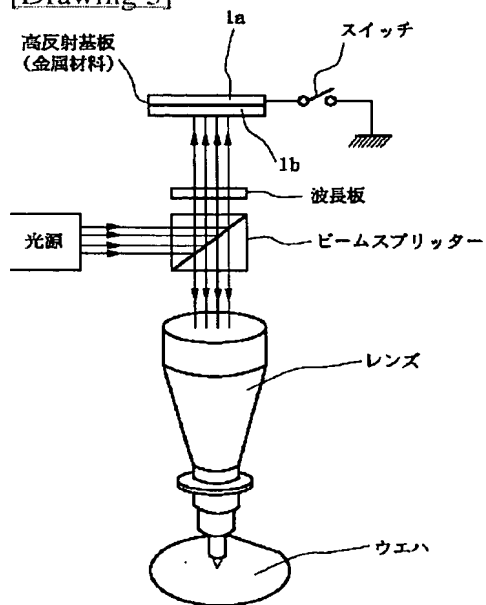
[Drawing 3]



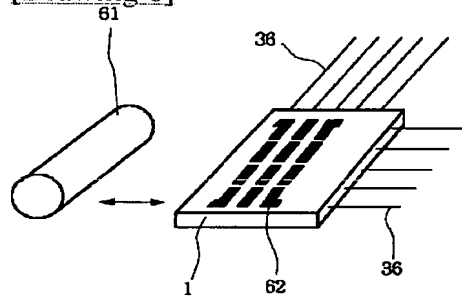
[Drawing 4]



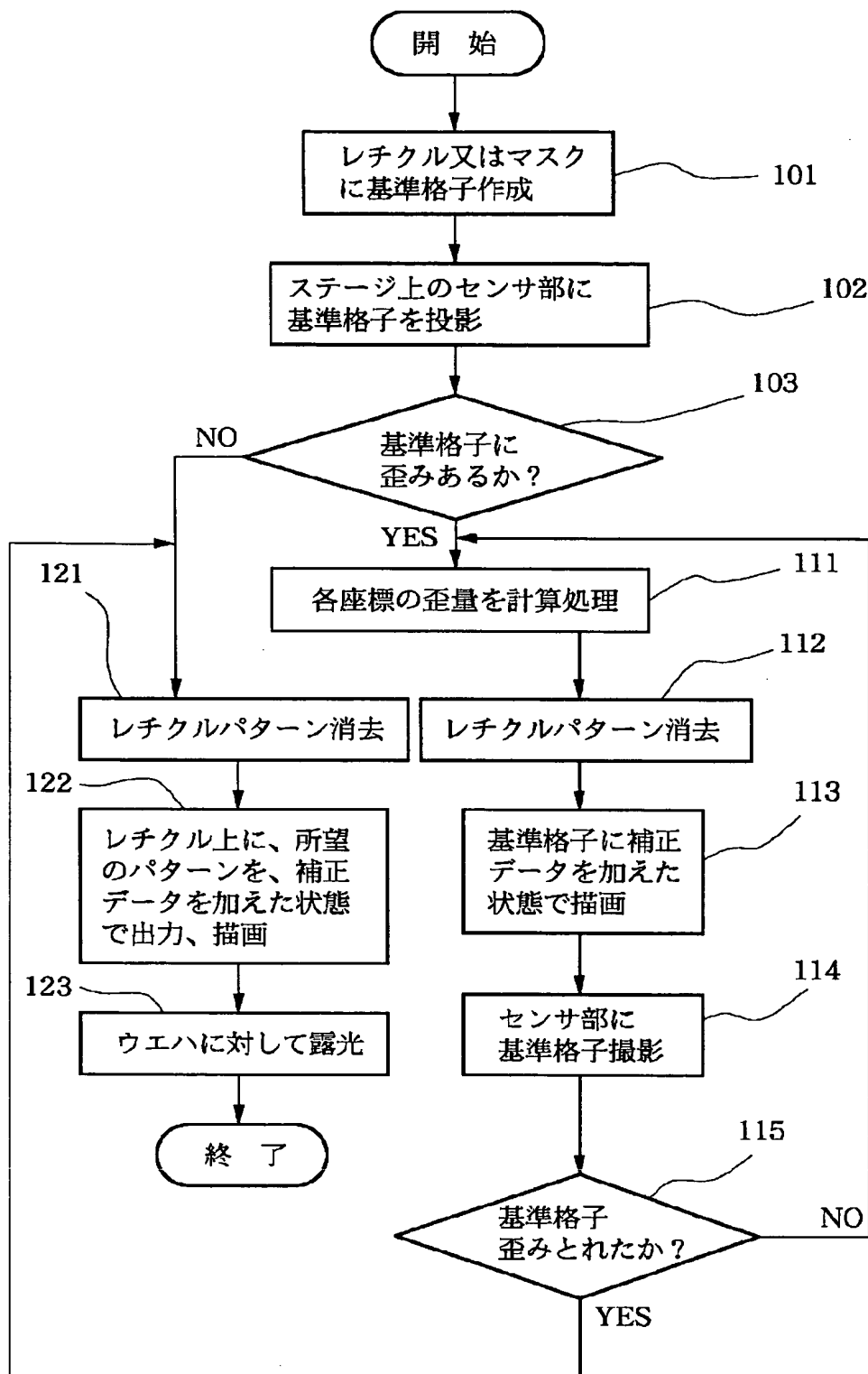
[Drawing 5]



[Drawing 6]



[Drawing 2]



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